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ABSTRACT

The major purpose of this study was to describe the rule-governed and contingency-shaped behavior of learning-disabled, hyperactive, and nonselected elementary school children working on a computer-managed task. Hypotheses tested were (1) that the children would differ in the degree to which either instructions or external contingencies controlled their behavior, with the hyperactive children being more sensitive to external contingencies, the learning disabled children more sensitive to instructions, and the nonselected children responding somewhere between; and (2) that the hyperactive children would show more response inconsistency and inappropriate responding than the other two groups. Ranging in age from 94 to 132 months, subjects were 20 referred hyperactive and/or attention deficit disordered children, 20 second- and fourth-grade learning disabled children, and 20 second- and fourth-grade nonselected children. Ten nonselected kindergarten children were involved in a concurrent developmental comparison study. Results revealed no interactions of diagnosis or grade with type of instructions. However, a fine-grained analysis of task performance yielded variables which discriminated grade levels and diagnostic categories. (RH)

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RULE-GOVERNED AND CONTINGENCY-SHAPED BEHAVIOR OF LEARNING-DISABLED, HYPERACTIVE, AND NONSELECTED ELEMENTARY SCHOOL CHILDREN

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PURPOSE

The major purpose of this study was to describe rule-governed and contingency-shaped behavior of learning-disabled, hyperactive, and nonselected elementary school children working on a computer-managed task. Hypotheses to be tested were: That the children would differ in their the degree to which either instructions or external contingencies controlled their behavior, with the hyperactive children being more sensitive to external contingencies, the learning disabled children more sensitive to instructions, and the nonselected children lying somewhere between; and that the hyperactive children would show more response inconsistency and inappropriate responding than the other two groups.

SUBJECTS

Subjects were 20 children referred through schools to a public health clinic for hyperactivity and diagnosed by the clinic physician or nurse practitioner as having attention deficit disorder with or without hyperactivity, 20 (10 from grade 2 and 10 from grade 4) children classified by their school as learning disabled, and 20 (10 from grade 2 and 10 from grade 4) nonselected children. The children ranged in chronological age from 94 to 132 months. Ten kindergarten children were also subjects in a concurrent developmental comparison study. For the grade comparisons, children were nonselected, that is, none of the children were labeled LD or ADD.

PROCEDURE

Children were seated before a PLATO terminal, whose video screen was touch-sensitive, which was being directed by a Control Data CYBER mainframe. The children had previous practice on other game-like computer-controlled tasks using the terminal. An actual-size replica of a typical screen display for the task is in Figure 1. Children were given standard instructions, including reading the written instructions on the screen. Instructions were repeated until the child indicated that they were understood. Only touches to the screen within the perimeters of the 5cm squares at designated times could be awarded points. Points were continuously displayed and updated when they were awarded.

A trial consisted of a brief (about 2 sec) display of two dots, simultaneously appearing in random positions, one within each of the two squares. When the appropriate dot was touched by the child, a point might be obtained. If a point could be obtained, a star next to the SCORE box would flash on and off for a brief period. To collect a point, the child had to touch the flashing star. If the child failed to touch one of the dots within the 2 sec presentation, the dots disappeared and, after a standard 1 sec intertrial interval, the next trial started. If the child failed to collect earned points by touching the flashing star, the star disappeared and a new trial began. Children could obtain a maximum of twenty points. Separate groups were run for the two conditions.

EXPERIMENTAL CONDITIONS

INSTRUCTION: "Touch dot in left square for points"

"Get as many ponts as you can".

CONTINGENCY: "Touch dot for points".

"Get as many points as you can".

AWARDING OF POINTS IN EACH PHASE OF TASK

PHASE	SCHEDULE FOR AWARDING POINTS	
Points 1 through 5	100% of left touches	0% of right touches
6 through 10	100% of left	0% of right
11 through 15	50% of left	50% of right
16 through 20	0% of left	100% of right

DEPENDENT VARIABLES

The following variables were measured: (1) for each task phase: the number of left hits (LX), right hits (RX), trial number of the first left hit (LF), and trial number of the first right hit (RF); (2) for the overall task: the first reinforced right hit (RRT), rights after the first reinforced right (RT1ST), the number of trials that lapsed without a response (MISSED), total number of trials to obtain 20 points, or to declare that no further points were obtainable (TRIALS), total number of points obtained (POINTS), and number of hits to inappropriate parts of the display screen (HITSOUT). Raw score means are reported here but in the statistical analyses log transformed scores were used wherever appropriate to equalize highly discrepant cell standard deviations.

The following derived variables were analyzed:

RESPONSES IN EXTINCTION = # of left hits in phase 4 adjusted for rule effect.

LEARNING DIFFICULTY = # of right hits in phases 1 and 2 adjusted for rule effect.

INVESTIGATE RIGHT = # of trials elapsing between the initial failures (50% rewarded) on the left and the first reinforced right.

INACCURACY = # of missed opportunities to collect available points plus the number of missed opportunities to respond left or right.

PERFORMANCE ADJUSTED FOR EFFECTS OF INSTRUCTIONS

	RESPONSES IN EXTINCTION	LEARNING DIFFICULTY	INVESTIGATE RIGHT	INACCURACY
NONSELECTED	39	5*	7**	24***
LEARN-DISAB	22	34	22	25
ADD	23	5	21	39

Note. Overall multivariate test TZSQ for Diagnosis $p<.001$.
*** $p<.01$; ** $p<.05$; * $p<.10$.

ADD children initially followed the instruction or the contingency in about the same way as NONSELECTED children. When the instructed rule or the contingency began to fail, however, ADD children extinguished LEFT and investigated RIGHT more quickly. In this, ADD children were similar to LEARNING DISABLED children. ADD children further differed from both other groups in their increased tendency toward missed opportunities, trials elapsed without a response and available points uncollected. LEARNING DISABLED children differed from both other groups most prominently in their difficulty in adhering to either the instruction or the learned contingency during the early phases.

PERFORMANCE ADJUSTED FOR EFFECTS OF INSTRUCTIONS

	RESPONSES IN EXTINCTION	LEARNING DIFFICULTY	INVESTIGATE RIGHT	INACCURACY
KINDERGARTEN	39	3	8	30
GRADE 2	39	2	9	27
GRADE 4	39	8	6	21

Note. All statistics non-significant.

RESPONSES IN EXTINCTION = # of left hits in phase 4 adjusted for rule effect.

LEARNING DIFFICULTY = # of right hits in phases 1 and 2 adjusted for rule effect.

INVESTIGATE RIGHT = # of trials elapsing between the initial failures (50% rewarded) on the left and the first reinforced right.

INACCURACY = # of missed opportunities to collect available points plus the number of missed opportunities to respond left or right.

PERFORMANCE WITHIN DIAGNOSIS AND RULE CONDITIONS

	RX1	RX2	RX3	RX4	RRT	MISSED
NONSELECTED						
INSTRUCTION	1.0#	1.2**	0.6***	2.7**#	118**	1.0##
CONTINGENCY	3.4	1.9	3.0	4.3	65	0.8
LEARNING DISABLED						
INSTRUCTION	14.7	1.8	0.6	3.9	94	1.0
CONTINGENCY	27.8	6.6	3.0	4.4	63	0.9
ADD						
INSTRUCTION	1.5	1.0	1.1	3.9	93	1.3
CONTINGENCY	2.7	3.7	3.5	7.8	40	1.0

Note. Overall multivariate test TZSQ for RULE $p<.05$.
*** $p<.01$; ** $p<.05$; * $p<.10$ for RULE.
# $p<.05$; #$p<.10$ for DIAGNOSIS.
All interactions were nonsignificant.

Overall, children had about twice as many RIGHT hits in the CONTINGENCY condition, compared to INSTRUCTION. LD children were slow to follow either INSTRUCTION or CONTINGENCY. LD and ADD children abandoned the instruction more readily. ADD children followed the changing contingency more readily. ADD children allowed more trials to elapse without a response.

PERFORMANCE WITHIN GRADE AND RULE CONDITIONS

	RX1	RX2	RX3	RX4	RRT	MISSED
KINDERGARTEN						
INSTRUCTION	0.6**	#2.0	1.6	3.2	113*	1.2***
CONTINGENCY	0.4	0.0	0.2	1.0	169	1.3
GRADE 2						
INSTRUCTION	0.0	0.0	0.0	2.2	138	1.1
CONTINGENCY	1.8	1.4	2.0	3.0	104	1.0
GRADE 4						
INSTRUCTION	2.0	1.4	2.2	3.2	98	0.8
CONTINGENCY	5.0	2.4	4.0	5.6	27	0.7

Note. Overall multivariate test TZSQ for GRADE $p<.10$.
*** $p<.01$; ** $p<.05$; * $p<.10$ for GRADE effect.
# $p<.10$ for RULE.
All interactions were nonsignificant.

RX1 through RX4: # RIGHT hits in phases 1 through 4.

RRT: Trial of first reinforced right hit (phase 3 or 4 only).

MISSED: # trials elapsed without a response.

USING PERFORMANCE TO CLASSIFY INTO DIAGNOSTIC GROUPS

	NUMBER OF CASES CLASSIFIED INTO GROUP		
	NONSELECTED	LEARNING DISABLED	ADD
FROM GROUP			
NONSELECTED	14	3	3
LEARNING DISABLED	7	12	1
ADD	8	3	9
TOTAL	29	18	13

F(3,55) MATRIX

	NONSELECTED	LEARNING DISABLED
LEARNING DISABLED	4.63	---
ADD	4.59	7.73

VARIABLES USED FOR CLASSIFICATION

INACCURACY
LEARNING DIFFICULTY
INVESTIGATE RIGHT

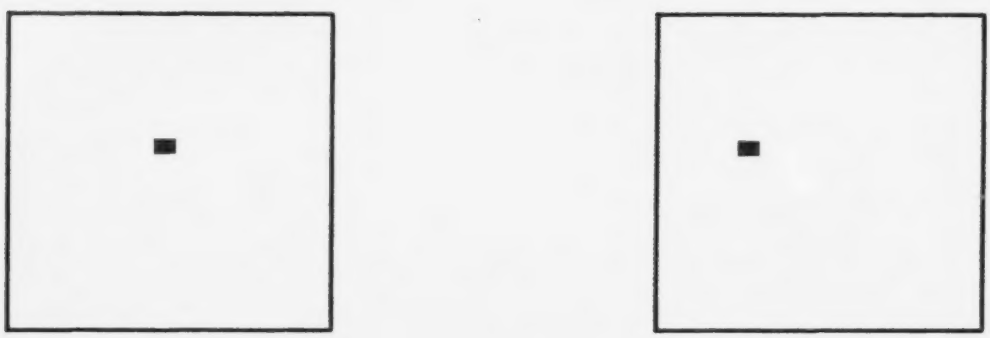
DISCUSSION

Although the results of this experiment do not bear out the a priori hypotheses, that is, there were no interactions of DIAGNOSIS or GRADE with type of instructions, the fine-grained analysis of task performance nevertheless yields variables that discriminate well both grade levels and diagnostic categories.

SCORE

* 3

Touch dot for points



SCORE

* 2

Touch dot in left square for points